

Fiscal Policy And Economic Growth In PIIGS Countries: An Empirical Assessment

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ABSTRACT

This paper studies the dynamic relationships between government revenues, government expenditures and economic growth in Portugal, Italy, Ireland, Greece and Spain (PIIGS henceforth). To this end we use a multivariate econometric model based on the Toda-Yamamoto (1995) procedure. Our empirical results reveal a bidirectional relationship between government revenues and government expenditures in Portugal only. Greece is the only country in which government expenditures Granger cause government revenues. Therefore, there is no evidence for spend-and-tax hypothesis for three countries of our sample. For Italy there is a unique unidirectional relationship running from government revenues to GDP while a unique unidirectional relationship was found running from government revenues to government expenditures for Ireland. Results for Spain show a double bidirectional relationships running from government revenues to GDP and from government expenditures to GDP. Moreover, there exists a unidirectional causal relationship between government revenues and government expenditures. Again, there is no evidence for tax-and-spend hypothesis for three countries of our sample.

Keywords: Fiscal Policy; PIIGS; Toda-Yamamoto; Granger Causality

I. INTRODUCTION

The effect of fiscal policy on economic growth is an ambiguous and long-standing issue in both theoretical and empirical research. It is also of critical importance for policymakers as they actively use fiscal policies to correct externalities and ensure satisfactory provision of public goods and services. Nevertheless, in practice, it is difficult to define the optimal policy because the reaction may differ from one country to another.

During the past few decades, literature on public finance has distinguished various hypotheses to describe the relationship between government revenues and expenditures. Those hypotheses can be classified into four categories¹. The first one is the *tax-and-spend hypothesis* proposed by Friedman (1978), Buchanan and Wagner (1978), which suggests that changes in revenues generate changes in expenditures. The authors argued that increases of tax will generate an increase in expenditures. The second assumption is the *spend- and-tax hypothesis* suggested by Peacock and Wiseman (1961, 1979) and Barro (1974) which reveals that changes in expenditures generates changes in revenues. The third hypothesis is *fiscal synchronization* early developed by the work of Musgrave (1966) and later developed by Meltzer and Richard (1981). This hypothesis assumes that government optimal fiscal policies rely on voters' decision process outcomes concerning their demand for public services and their reactions toward income redistribution (Manage and Marlow 1986; Miller and Russek 1990; Owoye 1995). Finally, the fourth hypothesis is institutional separation developed by Baghestani and McNown (1994) which considers that government revenues and expenditures are independent from each other. As there is no relationship between government revenues and expenditures, this hypothesis is characterized by non-causality in empirical terms.

¹ For more details, see recent paper of Hamdi and Sbia (2013).

Literature on fiscal policy is abundant and results differ from one study to another. For the US context, Ramey and Shapiro (1998) found that after a short increase in government spending, nondurable consumption decline slightly while durables consumption falls. Fatás and Mihov (2001) show that increases in government expenditures are expansionary, but lead to important changes in the composition of GDP in the form of an increase in private investment that more than compensates for the fall in private consumption (Afonso and Ricardo 2009). Blanchard and Perotti (2002) find that fiscal shocks have a positive effect on private consumption, and a negative impact on private investment. Afonso and Ricardo (2009) investigated the macroeconomic effect of Fiscal policy on GDP; their results suggest that an expansion of government spending is associated to an episode of fiscal deterioration. Similarly, an increase in government revenue is followed by a somewhat less disciplined fiscal policy.

The 2008 financial turmoil and the ongoing sovereign debt crisis have renewed the interest of academia (i.e. Kouretas and Vlamis (2010); Miroslav 2010, Hamdi and Sbia 2013), central bankers and governments in the role of fiscal policy. This is because the crisis shows how mismanagement of fiscal policy can be devastating for the welfare of a country and how effective fiscal policy is crucial for sustainable economic development. The current study enrich the available literature by exploring the dynamic relationships between government revenues, government expenditures and economic growth in PIIGS countries through the use of a multivariate causality framework based on the Toda-Yamamoto (1995) test, the so-called Modified-Wald test.

The reminder of the paper is as follows: section three describes data and the methodology, section four analyses the empirical results while section five concludes.

II. FISCAL POLICY AND GROWTH: A LITERATURE REVIEW

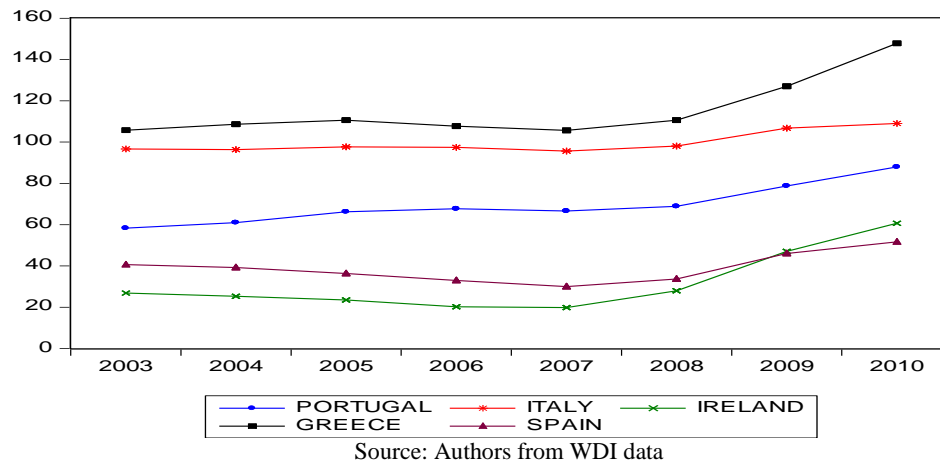
Literature on fiscal policy and economic growth is rich. The empirical research could be categorized in four axes. The first one explores the effects of budget deficits and fiscal consolidation on growth. Studies of this axe suggest that sustainable fiscal consolidation enforces investor confidence and creates budgetary resources for specific purpose without jeopardizing the sustainability of the government's financial position², or the stability of the economy in the long-run. Results of the first axe are interpreted as evidence of non-Keynesian effects during fiscal consolidation episodes. Researchers have pointed to the experiences of Scandinavian countries where fiscal consolidations have been generated strong growth. Some other cross-country studies based on many periods of large reductions in deficits demonstrate that fiscal adjustments are frequently associated with stronger-than average GDP growth. For example, the study of Kumar et al. (2007) concludes that while fiscal consolidations tend to have short-run contractionary effects, they can be expansionary in the long-run. The second axe examines the impact of the size of government on growth (where the size of the government is defined as the general government spending in proportion to GDP). The idea is to show that an uncontrolled public spending could negatively affect growth and fiscal imbalances would lead to high levels of taxation and borrowing. As a result investors will not have any incentive to invest or to innovate. Uncontrolled public spending is an attraction for corrupted bureaucrats and free riders. Broadly, the relationship between government size and growth rates has received great deal of attention since the early 1990s, with the pioneering paper of Barro (1991b). In his seminal paper, Barro extends the endogenous growth framework including tax-financed government services (Barro and Sala-I-Martin 1992). He concludes that government expenditure is positively linked to economic growth when the share of government expenditure (and consequently the tax rate) is low. But then turns negative due to increasing inefficiencies as the share of expenditure increases (related to the disincentive effect of higher tax rates on private capital accumulation). Thus, indicating a nonlinear relationship between government expenditure and growth (Bayraktar and Moreno-Dodson 2010). These expenditures must be financed by two types of taxation: those (such as income taxes) that are distortionary with respect to investment decisions, including human capital investment, and taxes which do not distort investment decisions. The third axe focuses on the role of governance. The impact of fiscal policy on growth will depends on the efficiency and effectiveness of the policy makers' decisions and thus, the quality of their governance. The quality of governance and public institutions has a direct impact on public expenditures and thus on growth (Burnside and Dollar 2000, 2004). Countries with better governance are generally able to collect taxes and spend public funds more efficiently and effectively. Thus, higher spending in productive areas can lead to higher growth

² See Giavazzi and Pagano 1990, Alesina and Perotti 1997; Alesina and Ardagna 1998; Perotti 1999, Miller and Russek 2003, Gupta et al 2005

in countries with strong governance, and higher spending in unproductive areas is not necessarily harmful to growth. In contrast, growth in countries with weak governance tends to be slowed by higher levels of unproductive spending and the higher taxes that are required to fund it, and they do not necessarily benefit from spending in areas that are typically considered productive (Bayraktar and Moreno-Dodson. 2010). Finally, the fourth axe analysis the impact of the composition of expenditures and taxes on growth. Broadly, not all expenditures and methods of financing have the same impacts on economic growth. Empirical evidence suggests that growth is very sensitive to the composition of expenditures. Government spending that improves the quality and quantity of factors of production, enhances the quality of legal framework, reduces markets barriers highly increases growth. In contrast, unproductive spending (defense, subsidies) may considerably hit growth.

Since 2007, several developing and developing countries have been experiencing serious government budget deficits and their fiscal positions have been deteriorated substantially, reflecting declines in the level of GDP. Among these countries, PIIGS are on the top of the list. As illustrates in Figure 1, central government debt (as percentage of GDP) has increased drastically since 2007 in PIIGS countries. The debt to GDP ratio reached 110% in Italy and 140% in Greece in 2010.

Figure 1. Evolution of Central Government Debt in PIIGS countries since 2003 (as % of GDP)



The current crisis shows how misconduct of fiscal policy can threaten the welfare of a country and how crucial effective fiscal policy is for economic development.

III. DATA AND ECONOMETRIC METHODOLOGY

This study uses annual real GDP, real government spending (GE) and real government revenues (GR) time series data covering the 1995-2009 periods for PIIGS countries³. All the data are taken from the Eurostat database, and the sample period is common for all countries.

a. Unit Root Test

To test for stationarity of the series, we firstly, we employ an Augmented Dickey-Fuller (ADF) unit root test. The extended maintained regression used in the ADF test can be expressed in its most general form as follows:

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \sum_{j=1}^p \alpha_j \Delta Y_{t-j} + \beta t + \omega_t \quad (1)$$

³ This is the longest available time series at international databases (IMF, WDI, Eurostat, OECD)

where μ is the drift term, t denotes the time trend and p is the largest lag length used. The null hypothesis H_0 : Y_t is $I(1)$, that is unit root, is rejected in favor of $I(0)$ if γ is found to be negative and statistically significantly different from zero. Common criticisms of these tests include sensitivity to the way the test is conducted (size of test), such that the wrong version of the ADF test is used. ADF test are also relatively sensitive to any incorrect establishment of lag parameter. Furthermore, this test tends to under-reject the null hypothesis pointing at non-stationarity too often. Consequently, to confirm the results of the ADF test a Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test was also conducted.

The KPSS statistic is based on the residuals from the OLS regression, which takes the following form:

$$y_t = \beta' D_t + \mu_t + u_t \quad (2)$$

$$\mu_t = \mu_{t-1} + \varepsilon_t, \quad \varepsilon_t \sim WN(0, \sigma_\varepsilon^2)$$

where D_t contains deterministic components (constant or constant plus time trend), u_t is $I(0)$ and μ_t may be heteroskedastic. Notice that is a pure random walk with innovation variance σ_ε^2 . The null hypothesis that y_t is $I(0)$ is formulated as $H_0: \sigma_\varepsilon^2 = 0$, which implies that μ_t is a constant. Although not directly apparent, this null hypothesis also implies a unit moving average root in the ARMA representation of Δy_t . The KPSS test statistic is the Lagrange multiplier (LM) or score statistic for testing $\sigma_\varepsilon^2 = 0$ against the alternative that $\sigma_\varepsilon^2 > 0$ and is given by:

$$KPSS = (T^{-2} \sum_{t=1}^T \hat{S}_t^2) / \hat{\lambda}^2 \quad (3)$$

where $\hat{S}_t^2 = \sum_{j=1}^T \hat{u}_j \hat{u}_t$ is the residual of a regression of y_t on D_t and $\hat{\lambda}^2$ is a consistent estimate of the long-run variance of u_t using \hat{u}_t . Under the null that y_t is $I(0)$, Kwiatkowski, Phillips, Schmidt and Shin show that KPSS converges to a function of standard Brownian motion that depends on the form of the deterministic terms D_t but not their coefficient values β . In particular, if $D_t = 1$ then

$$KPSS \xrightarrow{d} \int_0^1 V_1(r) dr \quad (4)$$

where $V_1(r) = W(r) + rW(1)$ and $W(r)$ is standard Brownian motion for $r \in [0,1]$. If $D_t = (1, t)'$ then

$$KPSS \xrightarrow{d} \int_0^1 V_2(r) dr \quad (5)$$

where $V_2(r) = W(r) + r(2 - 3r)W(1) + 6r(r^2 - 1) \int_0^1 V_2(r) dr$. Critical values from the asymptotic distributions (4) and (5) must be obtained by simulation methods.

The stationary test is a one-sided right-tailed test so that one rejects the null of stationarity at the 100 α % level if the KPSS test statistic (3) is greater than the 100 (1 - α) % quantile from the appropriate asymptotic distribution (4) or (5).

b. Toda-Yamamoto Procedure

Toda and Yamamoto (1995) propose a method that is used to estimate unrestricted VAR by the use of a Modified Wald test for restrictions on the parameters of the VAR (k) model and estimates a VAR [$k+d_{max}$], where k is the lag order of VAR and d_{max} is the maximal order of integration for the series in the system. The procedure of causality test of Toda and Yamamoto (1995) is expressed as follows:

Let $y_t = (y_{1,t}, \dots, y_{p,t})'$ a vector constitutes of p variables and estimated by VAR ($k+d_{max}$), where d_{max} is the lag order of integration of the following variables:

$$y_t = A_0 + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_{k+d_{max}} y_{t-(k+d_{max})} + e_t; \quad t = (k+d_{max})+1, \dots, T \quad (1)$$

In equation (1) e_t is an i.i.d. sequence of n -dimensional random vectors with mean zero and covariance matrix $\Sigma > 0$ such that $E[e_{i,t}]^{2+\delta} < \infty$ for some $\delta > 0$.

Equation (1) can be written as follows:

$$y_t = A y_{t-1} + e_t, \quad t = (k+d_{max})+1, \dots, T \quad (2)$$

where A is a matrix defined as $A = (A_0 \ A_1 \ \dots \ A_{k+d_{max}})$ and $y_{t-1} = (y_{t-1} \ y_{t-2} \ \dots \ y_{t-(k+d_{max})})'$

$$\text{Let } y = (y_{k+d_{max}+1} \ y_{k+d_{max}+2} \ \dots \ y_T) \Rightarrow y_l = (y_{k+d_{max}+1} \ y_{k+d_{max}+2} \ \dots \ y_T)$$

$$e = (e_{k+d_{max}+1} \ e_{k+d_{max}+2} \ \dots \ e_T)$$

Equation (2) became as follows:

$$Y = A y_l + e \quad (3)$$

The OLS estimator of A_v is: $A_v = ((y_l y_l')^{-1} \otimes I_p) \text{vec}(y)$, where $A_v = \text{vec}(A)$

$$\sum_A = \Gamma^{-1} \otimes \sum, \quad \Gamma = (y_l y_l') / T^*, \quad M_{y_l} = I_{T^*} - y_l' (y_l y_l')^{-1} y_l, \quad \sum = y_l M_{y_l} y_l' / T^*; \quad T^* = T - (k+d_{max}).$$

MWALD test is given by: $\lambda_w = T^* (R A_v)' (R \sum_A R')^{-1} (R A_v)$ has an asymptotic Chi-square distribution with J degree of freedom if $p \geq k+d$. R is the matrix of dimension (J, q) and $q = p(1+p(k+d_{max}))$ and if $R A_v = 0$.

Rambaldi and Doran (1996) show that MWALD test can be determined in a VAR regression by the use SUR (Seemingly Unrelated Regressions). In this case, equation (3) can be written as follows:

$$y' = y_l' A' + e' \quad (4)$$

By performing the operator vec in equation (4), it becomes:

$$\text{vec}(y') = (I_p \otimes y_l') \text{vec}(A') + \text{vec}(e') \quad (5)$$

Let $\alpha = \text{vec}(A')$, $Y = \text{vec}(y')$ and $u = \text{vec}(e')$, in equation (5) will be as follows:

$$Y = (I_p \otimes y_l') \alpha + u \quad (6)$$

$$E(uu') = \sum \otimes I_{T^*} \quad (7)$$

Vector Y is the sum of T^* observations of y_t followed by T^* observations of y_2 etc...until T^* of y_p . Vector α is constituted of parameters of vector A_v but with a different order. Equations (6) and (7) are the components of SUR. The covariance matrix of α is given by:

$$\sum \alpha = \sum \otimes ((y_l y_l') T^*)^{-1} \quad (8)$$

Let S a matrix with $S \hat{\alpha} = R A_v$, hence $S \sum \alpha S' = R \sum A R'$

The coefficient λ_w is equivalent to $(S \hat{\alpha})' (SV(\hat{\alpha})S')^{-1} (S \hat{\alpha})$, therefore λ_w is the statistic of Wald pour le test des restrictions $S \alpha = 0$.

The advantage of this procedure is that it does not require knowledge of cointegration properties of the system. This test can be done even if there is no cointegration and/or the stability and rank conditions are not satisfied (Zapata and Rambaldi, 1997). Arithmetically, the trivariate framework of our case study can be expressed as follows:

$$\ln GR_t = \alpha_1 + \sum_{i=1}^{k+d \max} \beta_{1i} \ln GR_{t-i} + \sum_{i=1}^{k+d \max} \beta_{2i} \ln GE_{t-i} + \sum_{i=1}^{k+d \max} \beta_{3i} \ln GDP_{t-i} + \mu_{1t} \quad (9)$$

$$\ln GE_t = \alpha_2 + \sum_{i=1}^{k+d \max} \beta_{2i} \ln GE_{t-i} + \sum_{i=1}^{k+d \max} \beta_{1i} \ln GR_{t-i} + \sum_{i=1}^{k+d \max} \beta_{3i} \ln GDP_{t-i} + \mu_{2t} \quad (10)$$

$$\ln GDP_t = \alpha_3 + \sum_{i=1}^{k+d \max} \beta_{3i} \ln GDP_{t-i} + \sum_{i=1}^{k+d \max} \beta_{2i} \ln GE_{t-i} + \sum_{i=1}^{k+d \max} \beta_{1i} \ln GR_{t-i} + \mu_{3t} \quad (11)$$

where $\ln GR$ is the logarithm of real general government revenues, $\ln GE$ is the logarithm of real general government expenditures; $\ln GDP$ is the logarithm of real gross domestic product. Payne (1997) is the first who modeled government expenditure with gross domestic product for Canada and then for a panel of countries. Narayan and Narayan (2006) have also used the same framework for a panel of developing countries and later Hamdi and Sbia (2013) for a panel of GCC countries.

To summarize the theoretical framework, Toda-Yamamoto method is performed in two steps. The first step consists in determining the lag length (k) of VAR model and the maximum order of integration (d) of the time series variables in the system. After the selection of optimum lag length VAR (k) and the order of integration $dmax$, a level VAR is estimated with a total of $[k+dmax]$ lags. The second step requests the application the standard Wald tests on the first (k) VAR coefficient matrix to make Granger causal inference using a chi square (χ^2) distribution.

IV. EMPIRICAL RESULTS

The empirical analysis is based on three steps. Firstly, we determine the order of integration of the series (d_{max}) and the optimal lag length k . To this end, we conduct Augmented Dickey–Fuller tests which will be confirmed by KPSS tests. Secondly, we determine the optimal lag length the model using the sequential modified LR test statistic (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ). The result of selecting optimal lag length of VAR indicates that lag order of VAR (k) is 2, for trivariate VAR. Thirdly, we augment the VAR by the maximum order of integration of the series (d_{max}) and then we test for any misspecification to ensure that the classical regression assumptions were not violated.

a. Unit Root Test: ADF and KPSS

We test for stationarity of the data series before proceeding with the Toda-Yamamoto Granger causality test. We employ an augmented Dickey-Fuller test on the time series in levels and differenced forms. Table 1 reveals the results of the stationarity analysis. The results show that we cannot reject the null hypothesis of unit roots for all variables in level forms. However, the null hypothesis is rejected when the ADF test is applied to the first differences of each variable. The first differences of the $\ln GDP$, $\ln GR$ and $\ln GE$, are stationary indicating that these variables are in fact integrated of order one, $I(1)$.

Further to the ADF tests, we employ the KPSS tests as indicated in table 1. Results show that government revenues, government expenditures and real GDP are non-stationary in their levels. These findings support those obtained from the ADF test.

Table 1: Unit Root Test

ADF

Variables	Greece		Italy		Ireland		Spain		Portugal	
	Level	1 st diff	Level	1 st diff	Level	1 st diff	Level	1 st diff	Level	1 st diff
LGR	-2.08	-2.44	-2.18	-1.73	-1.53	-3.10	-3.07	-2.58	1.14	-10.13***
LGE	-2.60	-4.88 ***	-1.15	-4.77**	0.29	-6.62 ***	0.24	-1.70**	-1.19	-2.33***
LGDP	1.15	1.04	-0.19	-1.26	0.09	-2.97	2.12	-0.45	-0.60	-2.97***

KPSS

Variables	Greece		Italy		Ireland		Spain		Portugal	
	Level	1 st diff	Level	1 st diff	Level	1 st diff	Level	1 st diff	Level	1 st diff
LGR	0.15**	0.35*	0.13*	0.08	0.15**	0.10	0.12	0.09	0.18**	0.50***
LGE	0.16**	0.50***	0.16**	0.36***	0.17**	0.49**	0.14*	0.13*	0.15**	0.16**
LGDP	0.13*	0.17**	0.16**	0.46**	0.17**	0.10	0.17**	0.16**	0.16**	0.48

Notes: ***, ** and * indicate significance at 1, 5 and 10%, respectively.

As our series are $I(1)$, this means that, $d_{max}=1$. Further, the result of selecting optimal lag length of VAR indicates that lag order of VAR (k) is 2, for trivariate VAR. Therefore, we can estimate a VAR system in levels with a total of $d_{max}+k$ lags for each country.

b. Toda-Yamamoto Granger Causality Tests

As we mentioned above, a multivariate Granger causality tests based on the Toda and Yamamoto (1995) procedure provides valid inference in the context of unstable, possibly cointegrated systems (Hamdi 2013). The results of these tests are presented in Table 2.

Table 2: Toda and Yamamoto Results

	Greece	Italy	Ireland	Spain	Portugal
GE => GR	19.84 (0.00)***	0.96 (0.62)	00.34 (0.85)	00.07 (0.97)	9.73 (0.00)***
GDP => GR	01.83 (0.40)	3.39 (0.18)	00.72 (0.70)	11.52 (0.00)***	2.32 (0.33)
GR => GE	00.31 (0.86)	2.95 (0.23)	16.04 (0.00)***	45.38 (0.00)***	50.66 (0.00)***
GDP => GE	00.44 (0.80)	0.08 (0.96)	02.90 (0.23)	90.55 (0.00)***	07.72 (0.02)**
GR=> GDP	00.90 (0.64)	8.32 (0.01)**	01.45 (0.49)	06.50 (0.03)**	1.11 (0.58)
GE => GDP	18.20 (0.00)***	0.61 (0.73)	00.56 (0.76)	17.47 (0.00)***	2.04 (0.37)

Notes: *** and ** indicate significance at 1 and 5 respectively.

The results of Granger non-causality test due to Toda and Yamamoto (1995) procedure are presented in table 2 and can be interpreted as follows. First, the results are not identical for the five countries; this is because of the heterogeneity of the economy of these countries.

Second, Portugal is the only country with a bidirectional relationship between the government revenue and government expenditure. This means that an increase in government expenditure rise government revenue and vice versa. Moreover, this implies that revenue and expenditure decisions are made independently in the 4 other countries. Furthermore, there is causal relationship running from GDP to government expenditure in Portugal.

For Italy, there is a unique unidirectional causality running from government revenue to GDP while a unidirectional causal relationship is running from government revenue to government expenditure in Ireland; thus there is an evidence of spend and tax hypothesis.

Turning now to Greece, results reveal a unidirectional relationship running from government expenditure to government revenue which support the 'spend and tax hypothesis' and another unidirectional causality running from government expenditure to GDP. The Greek fiscal policy based on expenditure is advantageous for the economy rather than another policy. Based on these findings, we can say that the current reforms adopted by the government, which are based on austerity, are harmful for the Greek economy and they cannot be considered as the proper policy responses.

Results for Spain reveal a bidirectional relationship between government revenue and GDP as well as bidirectional causality between government expenditure and GDP. This shows that an increase in revenue or in expenditure affects positively the output. Moreover, results show a unidirectional causal relationship between government revenue and government expenditure which support the *tax-and-spend hypothesis* suggested by Friedman (1978) and Buchanan and Wagner (1978).

V. CONCLUSION

This study has employed the Toda and Yamamoto (1995) procedure to determine the Granger no-causality tests between government revenues, government expenditures and growth for PIIGS countries. The tests are based upon annual time series for the period of 1995-2009. Toda and Yamamoto causality test based on trivariate VAR model indicates bidirectional relationship between government revenues and government expenditures in Portugal only. Greece is the only countries (with Portugal) in which government expenditures granger cause government revenues. For Italy there is a unique unidirectional relationship running from government revenues to GDP while a unique unidirectional relationship is running from government revenues to expenditures for Ireland. Results for Spain show a double bidirectional relationship running from government revenue to GDP and from government expenditures to GDP. Moreover, there exists a unidirectional causal relationship between government revenues and government expenditures.

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